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Is Zero a Signed Number?

Date: 01/09/2002 at 10:27:50
From: Intisar hussain
Subject: Zero

Please tell me, Dr. Math,

Is zero a directed number? What is the direction of zero? If zero is not a directed number, why do we use it in the set of directed numbers?

Example: When we place directed numbers in line:

-4, -3, -2, -1, 0, +1, +2, +3, +4

Date: 01/09/2002 at 13:07:05
From: Doctor Peterson
Subject: Re: Zero

Hi, Intisar.

Probably you are using "directed numbers" to mean something like "signed numbers"; it appears that this is a British school term for what we would properly call "integers" or "real numbers," with the emphasis on the presence of a sign. It is meant to be descriptive, not a precise definition, and I think you may be taking the term too seriously.

I would say that "the set of directed numbers" refers to numbers in which we are allowing both a length and a direction (sign). In the case of zero, the direction is meaningless, since $+0$ and -0 are the same; but that does not mean that it has no sign, only that the sign makes no difference.

The important point about the set is not that each member of the set must have a significant "direction," but that directions are allowed, so that the set does not consist only of positive numbers. That is, no claim is made that you can separate out the size and direction for every such number, so that each number (including zero) should have a specific direction; rather, numbers in the set are built by combining a "size" and a "direction" (sign), and there is nothing wrong with both $+0$ and -0 turning out to be the same number.

Moreover, I would not even say that any particular number is "a directed number"; rather, a number like 1 (or 0) may be treated either as a mere number (by children who have not yet learned about negative numbers, or when only positive numbers make sense), or as a "directed

number" in contexts where signs are meaningful. It is really only "the set of directed numbers," or "operations on directed numbers," that are significant, not the individual numbers.

If we tried to formally define the "integers" (directed whole numbers) or the "real numbers" as numbers that combine size and direction, we would have difficulty in stating clearly what we mean. But if you are using "directed numbers" just to indicate that you are working with numbers with (optional) signs, and not as a formal definition of a set, then there should be nothing wrong with accepting that zero belongs in this set.

- Doctor Peterson, The Math Forum
<http://mathforum.org/dr.math/>

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